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# **The social construction of invertebrate invasive species in public and scientific media**



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# The social construction of invertebrate invasive species in public and scientific media

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## ABSTRACT

Invasive invertebrates are common in the United States and their effects on local ecosystems can have detrimental consequences extending beyond biological processes to economics and other social arenas. Over anthropogenic time, human value systems were woven into the perspectives of nature to form a social constructionist perspective on the natural world. We strive toward a certain closeness with nature, and, in effect, attempt to understand it. Through comparison of the discussion of invasive species in online public media and scientific journal articles, this paper examines how nature is socially constructed in different contexts. The study demonstrated that journalists used anthropomorphism 70% more often than researchers, and wrote about social value categories, including economics, aesthetics, and ecological effects 85% more often than scientists, on average. In general, online news journalists used language that was considered negative or suggestive 78% more often than scientists. Environmental issues do not occur in a bubble, so it is imperative to realize that the interactions between all living things, including humans, drive both biological and sociological processes. These findings can help guide how we understand media production about invasive species.

## Introduction

Global exploration and trade, in conjunction with an ever-growing world population, have brought about numerous environmental changes on global and local scales. Because of extensive transit to and from North America across a wide range of industries, as well as exponential social and economic growth the accidental and intentional introductions of non-native species to the United States have become legitimate concerns.

Much attention has been paid to the ecological disruptions caused by non-native species, but the social implications of invasive species are less tangible. Studies of invasive species take a predictive stance, in that scientists can understand the potential ecological effects, but they cannot assert the overall social outcomes with certainty.

Studies and commentaries on invasive species abound after they arrive in a new habitat. Scientific papers quantify their rate of spread or how they interact with local species but there are also outcries from local papers, radio shows and pamphlets, the sides of buses, and even billboards are used to spread awareness about the “invaders.” Clearly, certain entities want citizens to be aware of the existence of invasive species and their potential consequences. Often, citizen advocacy and political response is necessary in the environmental realm, and this creates tension between informational bodies of text.

It is unclear how different writings construct their discourse about the invasives. There are parallel discourses in scientific research articles and public media that can vary on a number of social dimensions. By examining texts from public and scientific writings we can obtain a strong look at how the social world treats invasives. The available information about invasive species tends to be muddled by journalistic bias; a disjunction exists between emerging scientific research and the synthesis and presentation of this research to the public.

This paper takes a social constructionist perspective to invasive species to understand the social causes of natural and “unnatural” processes. The introduction of a non-native species is inherently a mixed social and natural process where human societies, intentionally or inadvertently, shape ecosystem dynamics. Even the term “invasive species” although it is rooted in scientific jargon, is a construction. “Non-native”, a more neutral term, does not evoke the same social tension as “invasive.” In scientific terminology, a species’ categorization changes from non-native to invasive when it demonstrates the ability to colonize after introduction to a region outside of its natural habitat. Using contextual imagery, or the automatic assumptions one makes in connection to the use of certain words, one can imagine an invader as a threat to one’s home or personal security. Using the same imagery exercise, the term “exotic” covers the middle ground between non-native and invasive, due to connotations linked to culture, which are generally positive, and

certain tropical diseases, which are clearly negative. Reactions to these terms are rooted in connotations constructed over time through society, and promote syntax as a powerful tool in communication.

The American perception of invasive species is deeply rooted in social value systems, but we must question what entity is responsible for the education of the public and what cultural frames are being present to everyday Americans.

This study seeks to profile the themes that readers are exposed to when they learn about invasive species through online media. Such language plays to the social constructions society developed over time to frame these species in an anthropocentric manner. Focusing on three invasive invertebrate species as case studies, this analysis will compare the discourse of online news pages on non-native species to scientific journals. This comparison will afford a detailed look at how texts from different parts of the social world treat non-natives. It is clear that scientific studies aim for objectivity and online news sources are more informal but how these different texts actually discuss a loaded topic like invasive species, and the degree to which they anthropomorphize has not been studied.

The aim of the analysis was to show the differences between online news media and scientific literature by highlighting the use of specific words, phrases, or implications that demonstrate the anthropomorphism of invasive species in each type of media. This analysis may help the public better understand that due to

economic, ecological, and aesthetic interests, this topic is socially loaded and vulnerable to construction. Undoubtedly, certain news sources (namely television, radio, and newspapers) are more accessible, both physically and intellectually, to the public in comparison to peer-reviewed scientific journals.

By including scientific research articles this study will look at how “objectivity” holds up in the context of non-native cases. In conveying their research, scientists aim for clarity, and shy away from imagery or metaphor (Harmon and Gross, 2010; Lebrun, 2007). Scientists are distrustful of imagery on the grounds of shrouded objectivity. They also attempt to avoid writing with “cognitive baggage” as to appeal to the intellectual side of the reader rather than the emotional side. To engage the intellectual, scientists are more apt to use quantitative language such as “interaction,” “conclusion,” or “hypothesis” (Lebrun, 2007).

By definition, objectivity is a mainstay in journalism as well as scientific research, but it is possible that the intended audience and scope of an author’s work has an inherent influence on the syntax and language used to portray ideas. Journalists often use more informal language and evocative imagery to give their stories more engaging content. Their language may be an important part of the construction of public discourse about non-natives and understanding the way they talk about this topic is an important first step.

### ***The Social Construction of Nature***

In American Perceptions of Immigrant and Invasive Species, Peter Coates asks, "How do we weigh up what is good and what is bad in nature? Clean and dirty? Healthy and unhealthy? Beautiful and ugly?...Are the problems associated with non-natives primarily of a material order-ecological and economic in other words? Or are social and cultural factors... uppermost in identifying troublesome species?" (Coates, 2006) This extends to the study of invasive species, and to answer these questions, we must delve into the entity we describe as "nature." In western society, the belief that humans have dominion over the natural world stems from numerous sources, including religion, ethics, economics and technology. Traditionally, these disciplines encourage the illusion that nature is vast, that limitless opportunities for progress exist, and that technological ingenuity will continue to ensure that nature will persist regardless of anthropological destructive practices (Frey, 2001; Eder, 1996). This paradigm rests on shaky foundations.

Environmental Sociologists argue that our definition of nature is contingent upon social and historical contexts (Hannigan, 1995). Perceptions of nature are based on cultural themes and continually evolve in concert with contemporary issues. The Ages of Exploration, Imperialism, and Industrialism encouraged an anthropocentric view of nature where wilderness and indigenous peoples were framed as entities to be tamed. In the post-industrial society of the late 20<sup>th</sup> and early 21<sup>st</sup> Centuries, this value system

is changing. The anthropocentric perspective promotes activities that protect or improve the station of future generations, which, until recently, have been significantly destructive to the natural world. As we look further into the future, however, these actions ultimately jeopardize the interconnectedness of all living things, including wildlife, plants, and humans (Benton and Short, 1999).

This understanding generates a new discourse on the intersections between human value systems and nature. Bubbling brooks and tree studded mountain vistas are no longer pre-modern romantic notions; they are recognized as essential to life on this planet (Eder, 1996). Human values determine which consequences are considered environmental harms and which harms are acceptable sacrifices for human progress. These values are rooted in economics, aesthetics, ethics, and science; human perceptions of ecological factors in relation to these vectors induce an inherit response, ingrained in us by society over a lifetime of exposure. However, positive and negative values are becoming blurred as we begin to realize the global implications of our actions (Keller, 2009). This dynamic uncertainty is evidence that nature is an abstract construct, reliant on the values humans designate to it to define its purpose.

### ***Cultural Implications and Social Awareness***

The mechanism underlying the social construction of nature is complex, but it is evident that human value systems drive our perspectives of nature. Construction allows for



plasticity in the way we view the natural world, depending on certain influential factors including human choices and actions, that create a feedback system between human populations and the environment (Keller, 2009). Instinctively, human choice is dependent upon the perception of risk, which plays an integral role in political and economic decision-making on all scales. The worldview on risk generally stems from the perception of personal well-being or that of our progeny. In theory, an understanding of risk can be cognitive, or a result of conscious thought, but it can also be related to affect and emotion, which manifest much more subtly and can thus be driven by media influence (Leiserowitz, 2006).

The environment is an intergenerational resource and must be socially recognized as such. Our decisions about invasive species management and control certainly affect our economy in the short term, but we must also take their long-term effects on ecology and posterity under advisement when appropriating a value system. Environmental issues transcend the technological, and prompt questions involving social standards and community needs (Keller, 2009; Thompson, 1997).

These are not localized or minor issues; they require genuine social awareness and education among all sectors of society. Limiting the environmental discourse to the scientific domain by disregarding public opinion would be restrictive and wasteful at best, but a functional understanding of these issues requires the comprehension of extremely complex ecological and economic

models, as well as the fundamentals of policy. Therefore, we must rely on experts and journalists to synthesize and disseminate information truthfully, realistically, and accessibly. In their essay entitled "The Social Bases of Environmental Concern: Have They Changed Over Time," Robert Emmet Jones and Riley L. Dunlap state, "As environmental problems become more obvious, ubiquitous, and threatening to human health, awareness and concern about them will be less and less limited to any given sector of society." (Frey, 2001) This optimistic statement has a reasonable basis with respect to invasive species, but one must consider the mechanism of information dissemination that leads to this ubiquity.

### ***The Influence and Role of the Media in Invasive Species Discourse***

Contemporarily, many facets of the environment enjoy daily mention in the public media forum. The importance of environmental issues is emerging onto the forefront, but in general there are few accessible and reliable resources beyond popular news media for personal educational enrichment. Therefore, journalists have assumed the role of public educators, and the public relies on the media professional's knowledge of the subject matter and ability to report without bias or preconceptions (Durnil, 1995). Often, newspapers, television, and radio are the primary resources for the general public's exposure to environmental issues. When scanning multiple news sources, the reader is bound to encounter various tilts to the same story. Inherent biases are woven into

each piece of writing, so subject matter is easily clouded by multiple authors' personal biases. This situation becomes increasingly difficult to navigate when the field of available sources broadens beyond published news and into the realm of online news sources, editorials, and blogs.

Print pages are limited, but the emergence of online news resources enables an array of topics to be covered in depth. Internet-based news sources are drastically changing the journalistic scene (Wyss, 2007), but monitoring these sources for objectivity and comprehensiveness is increasingly difficult. Theoretically, these should be trusted and reliable news sources in the same vein as their printed predecessors.

The method of framing certain environmental issues such as the effects of invasive species can have a significant impact on the public agenda (Wyss, 2007). The power of the press has a profound influence on public opinion and helps to structure the human value system (Sachsman et al., 2010). The use of certain suggestive terminology and phrasing in journalism has a strong influence on the perceptions of the American people toward environmental issues, including the effects of invasive species. Words, phrases, and syntax have ingrained social connotations that suggest distinctions between invasives and their hosts (Coates, 2006). Anthropomorphism, or the attribution of human characteristics to non-human organisms or entities, tends to manifest in such situation. Journalists, through their creative processes, have the potential to weave stories of disguised advocacy and

suggestive language. For instance, because a tree species is not sentient and is integral to our constructed relationship to nature, it can easily be framed as vulnerable, and in need of protection, whereas, ecologically, trees have adapted many mechanisms for defense.

As the public becomes more dependent on the media for environmental fodder, journalists working the "green beat" are more likely to become advocates for the environmental cause. This advocacy plays into the public discourse, which tends to take precedence over personal background knowledge (Eder, 1996). The use of influential phrasing or language, including anthropomorphism, which differentiates the invasive invertebrate from the host through attribution of human characteristics to nonhuman organisms, contributes to emotionally driven decision-making and agenda setting.

The role of environmental journalists wavers between the objective informant and the educator. Currently, many journalists lean toward education because they realize that few other accessible sources for environmental information exist. Journalists feel responsible "to illuminate issues of importance in a manner that enables citizens to participate intelligently in the democratic process." (Frome, 1998) With that extent of burden of responsibility, it is not surprising that journalists develop an inadvertent pro-environmental tilt in their writing.

Conversely, scientists have a different set of ethical standards. They seek to relay the results of their research objectively and do not



intentionally conform to the importance of the value systems previously discussed (Thompson, 1997). They aim to inform their peers rather than the public through publication in scientific journals and neutrality is a lofty component of the legitimacy of these publications. Such objectivity concerns writers in the public sector. Environmental journalists fear that if an article presents multiple sides of an issue (namely a “balanced” article) it could sway readers beyond the neutral point, resulting in a public that fails to see the merits of the journalist’s arguments (Durnil, 1995). Therefore, journalists must walk a narrow path between necessary objectivity and dangerous neutrality.

The relationship between science and policy is complicated, which makes writing about inherently scientific topics in a manner that the public can digest challenging. Environmental journalists must interpret and disseminate information that took years of scientific research to yield. These writers are required to be familiar with numerous topics, and their interpretations often make them seem pro-environment (Wyss, 2007). Consequently, information about nonnative species is prone to severe fragmentation (Bright, 1998) before it reaches the public.

Environmental ideologies are expanding due to the phenomenon of green washing, and although green washing promotes the commercial side of environmentalism, heightened public awareness can be beneficial for those working toward environmental goals. Green washing claims can be detrimental to movement as a whole, but it does pique the public’s interest

through manipulation of the human emotional value system (Benton and Short., 1999). Journalists realize that sensationalized writing may be the way to gain the necessary attention. Often, the public is only exposed to such issues through newspapers, television, and radio (Frome, 1998) but political and regulatory action concerning these issues, including legislation, requires public interest and activism. Proper defense of an issue compels people who are educated, passionate, and willing to fight for the success of their cause. Therefore, civic activism may be the best prescription for conservation (Bright, 1998). Politics are by definition reliant on the public, and a public that views invasive species as malicious or detrimental to local economics, aesthetics, and economies is bound to fight for conservation.

Is it possible that we expect too much from environmental journalists? Human value systems are complex and overarching, in that we trust our news sources to be reliable and objective, yet we also assume journalists will educate us and disseminate knowledge gained in the world of science. Logically, these are conflicting expectations, especially when articles are written about controversial topics such as conservation and the management of invasive species. Bob Wyss claims that “the newspaper webpage can be, and should be, best place to go for the most comprehensive and most objective information” (Wyss, 2007) but objectivity is, in itself, a controversial topic. As previously stated, bland neutrality may actually do an injustice to an important social

issue, especially when existing public awareness is limited.

Here, the use of suggestive language in online news articles is compared to that in reputable scientific journals to distinguish the plausibility of such instances where the public is positively or negatively swayed by their daily reading.

## **Materials and Methods**

### ***Biological Basis***

Hemlock Woolly Adelgid, Emerald Ash Borer, and Asian Longhorn Beetle are imminently problematic species in the Northeast. Each of these invertebrate species was introduced to North American forest ecosystems from temperate Asia. Asian species tend to thrive in North American habitats because the two continents share similar climates, water availability, soil composition, and species diversity. The increasing pace of globalization allows for the repeated transport and introduction of numerous temperate species across oceanic divides. The eventual result of such introductions is a mosaic of ecologically improbable species interactions and evolutionary anomalies. Non-native species tend to flourish under unfamiliar conditions because those that colonize quickly are impressive competitors. They are able to successfully vie for resources against native species, and once they become established, native species are unlikely to recover.

In reference to the three invertebrates here, it is important to understand that their respective host tree species are long-lived and apparent in ecosystems. Trees that are subject to introduced insects are

not armed with necessary defenses, but the insects are armed with the ability to exploit them as hosts because of similarities that exist between temperate tree species globally. This leads to rampant invasions that cause apparent environmental consequences.

Invasive species are not uncommon in the Americas. The National Park Service considers invasive species to be more threatening to the integrity of the parks than air pollution, oil drilling, and other anthropogenic pressures (Coates, 2006).

Ecologically, invasive species are capable of inflicting damage to our native lands. This becomes increasingly worrisome with respect to economically important resources such as agricultural acreage and timberlands. Bob Devine calls for a “substantial response” to invasive species, as they can indirectly change the way we live by transforming the American landscape. Widespread damage to a few forest species has the potential to irreversibly affect the ecosystem as a whole (Devine, 1998). At that point, humans may become cognizant of how strongly the natural world is integrated into human value systems.

### ***Research Design***

Content analysis was performed to determine the disparities in the use of suggestive or provocative language between easily accessible articles from web-based news sources and scientific articles accessed through online journal databases. Articles from both sources were selected according to strict qualifications.

News articles were discovered using an Internet based email alert service, which scans for specified keywords in recent news on a daily basis. Searches were generated using the common names of the three species considered in this study: Hemlock Woolly Adelgid, Emerald Ash Borer, and Asian Longhorned Beetle. Upon receiving notification that articles contained a key word or phrase, they were evaluated based on the criteria delineated here. To be accepted into the study, articles had to be of sufficient length (at least one page or 350 words), originating from a region east of the Mississippi River to ensure geographic proximity to the affected areas, chronologically relevant (here defined as within two years of the study), and within the confines of an online “local” newspaper or editorial, rather than a blog or personal opinion page. “Local” was used as a designation to ensure that the news source was reputable, but also to avoid the inclusion of periodicals that cover national or global audiences. The first fifteen articles that satisfied the requirements were selected for each species.

Scientific articles were selected using a university library-based “Holmes One-Search” search engine. A majority of the scientific journals accessed required university credentials. Deviations from the original criteria for news articles occurred only in source and chronology. Scientific journals reach audiences spanning a larger geographic area and long distance collaborations are common, so leeway was given in reference to geographic origin. Also, studies conducted within

the past five years were considered, due to the time-consuming nature of a scientific study. Because of length and availability, five scientific publications for each species were selected. Articles composed by duplicate primary authors in each category were discarded, as to avoid personal biases.

The categories used for analysis were determined by browsing a portion of the articles for words or phrases that seemed especially integral to the overall tone of the articles. Categories suggested in literature were also considered and modified to fit the scope of this study (Coates, 2006; Harker and Bates, 2007). Categories ranged from provocative to neutral statements, and covered both ecological and social values. A table was created to enable the succinct compilation of data. This table is shown below:

Category
<b>Host Species:</b>
Aesthetically pleasing
Crucial for ecosystem
Crucial for economics
Anthropomorphism (vulnerability)
<b>Invasive Species:</b>
Anthropomorphism (malicious/intentional)
Menace/evil/aggressive/opportunistic/pest
Detrimental to ecosystem
Detrimental to economy
Neutral descriptors (non-native, exotic, invasive)

The categories for analysis were chosen based in three sociological

aspects that are important in the human value system, including economics, aesthetics, and ecology. Anthropomorphism was recognized for both host trees and invasive invertebrates, but they contain very different implications, so they were clearly delineated. Descriptors were partitioned to “negative” and neutral terms, and the neutral terms acted as a control to ensure the investigator did not qualify all adjectives as negative. Therefore, those designated as negative have purely damaging social connotations.

### Analysis

Each selected article was carefully read by one investigator, and each categorical instance was tallied. A single investigator was used to ensure consistency in frame of mind and background knowledge across the entire data set. Totals were calculated by article, by species, and by source, as to best discern where and how frequently conspicuous discrepancies in language use occurred. Overall word counts were also calculated according to the previous designations, as to represent categorical occurrences in the form of a rate. This step was added to normalize the data, and to remove the possibility that the data was skewed due to article lengths across species subsets, or the number of articles from each source.

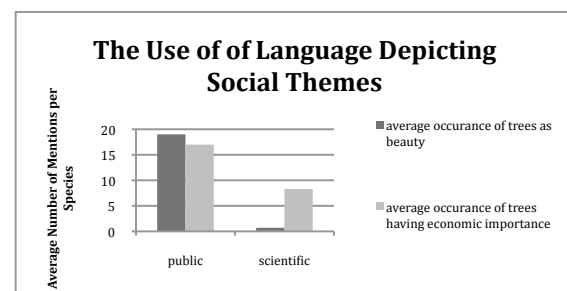
Data was compiled and compared across information source (public news or scientific journal) and also by species (tree host or invasive invertebrate) depending on the category. The comparisons were completed using pure numbers and occurrence rates to better

demonstrate the overall tone of the articles as a subset. Percent differences were calculated to best represent disparities as well.

A matrix was designed to organize and quantify the data. Results in their purest form are extrapolated using rates and adjusted rates to normalize for total word count discrepancies. Arithmetic means are utilized to simplify and synthesize results.

### Results

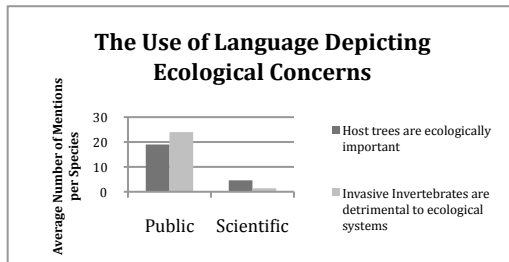
Differences arose between the use of language in public and scientific journals. The social implications of the potential effects of the three invasive invertebrates were considered in two categories. The aesthetic qualities of the trees were considered, as was the economic importance of these species. The data show that both topics were discussed at length in public media, but rarely mentioned in scientific articles, as shown in Figure 1.



**Figure 1: Public media mentions social value categories more often than scientific media, but little difference between the importance of aesthetics and economics are found, whereas scientists mention economics more often.**

Figure 2 shows the average occurrence of ecological concerns mentioned in the literature. The data demonstrates that public media

discusses both the importance of the host trees and the detriment of the invasive invertebrates to those host trees. Scientific writers are more apt to discuss the ecological importance of the host tree species in comparison to the detrimental effects of insects, while public media articles are more likely to discuss the harmful aspects of the invasive species. In both categories, the use of language depicting ecological concerns was significantly more common in public media than scientific media.



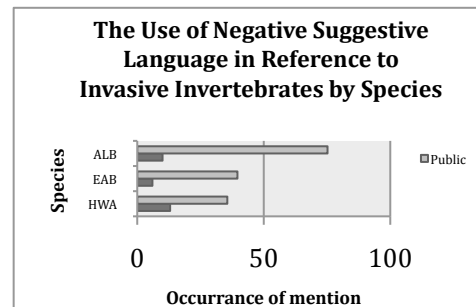
**Figure 2: Public media openly and directly discusses ecological implications more often than scientific media, although there is a marked occurrence of mention of trees as ecologically important species in this type.**

Table 1 illustrates quantitatively that public media mentions social value categories more often than scientific media. Overall, public media is 85% more likely to mention these value categories. The largest disparity exists in the aesthetics category, which is the most subjective and least quantifiable of the grouping.

Human Value Category	Public Media (%)	Scientific Media (%)	%Occurrence of Disparity
Aesthetic	0.21	0.0037	79%
Economic	0.15	0.013	86%
Ecology	----	----	----
Hosts	0.19	0.0046	86%
Invertebrates	0.24	0.14	90%
Average			85%

**Table 1: Quantified differences in rates of occurrence between public and scientific media in the human value categories. Comparisons between rates are presented as percentages.**

Words such as menace, pest, evil, etc were qualified as negative and suggestive due to accepted social connotations. Differences in occurrence for negative suggestive language are presented in Figure 3 by species and by media type. For all species, public media sources are significantly more apt to use this type of influential language, and scientists use it minimally.



**Figure 3: The use of certain influential terms, as described in the Methods section, were more common in public media regardless of species.**

Table 2 demonstrates quantitatively that public media outlets utilize negative suggestive language significantly more often than scientific media outlets. On average across the three species cases, public media was

78% more likely to use this type of influential language.

Species	Public (mentions/total words)	Scientific (mentions/total words)	% Discrepancy
Asian Long-horn Beetle	75.2	10	87%
Emerald Ash Borer	39.6	6	85%
Hemlock Woolly Adelgid	35.6	13	63%
Average			78%

Table 2: Quantitative representation of the use of negative suggestive language in each type of media.

The use of anthropomorphism was a common theme. Anthropomorphism was described in two ways. In reference to the host trees, any reference to the vulnerability of the trees was considered anthropomorphism. In reference to the invasives, any suggestion that the invertebrates were intentionally harming the host trees was considered anthropomorphism. Figure 4 depicts this data. Quantitatively, it was calculated that the public media is 70% more likely to use anthropomorphism than scientists, and within this use, they are also 70% more likely to anthropomorphize insects rather than tree host species.

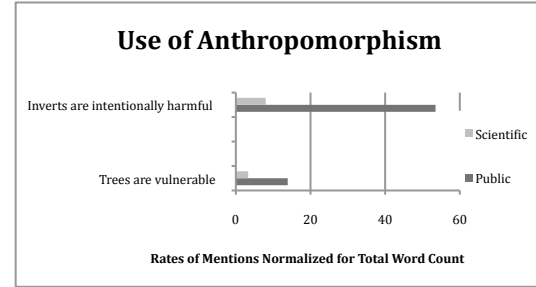


Figure 4: Public media was found to anthropomorphize both organism types significantly more often than scientific media. This literary device was rarely used in technical writing.

## Discussion and Conclusions

Portraying environmental concerns such as invasive species in neutral terms may not produce the necessary response from the public. Instead, these types of communications must be relatable and integrated into ingrained human value systems (Devine, 1998). Figure 4 demonstrates that anthropomorphism exists in both scientific literature and online news articles, but it is significantly more common (70%) in the publicly available media. Anthropomorphism may be a natural and necessary means of communication. The justification for this could be that humans require the ability to identify, distinguish, and subsequently reject or accept specific notions or entities in reference to an inherent set of human values (Coates, 2006).

Aesthetics were found to be mentioned 79% more often in public news media than scientific literature. Humans tend to relate closely with scenes of nature, which can remind them of childhood memories, evoke a sense of home, or maybe even spark sentiments of spiritual transcendence and humility. This may be an artifact of dependence on certain landscape

features for sustenance over historical time. In the case of these invasive species, their ability to decimate entire tree stands, as well as majestic individuals that may hold some sentimental meaning for a person, could potentially change the American landscape (Devine, 1998). Portraying this threat in aesthetic terms in publicly available social media could most definitely elicit a strong response in the general reader. Such a response may be the best way to invoke civic action and political responsibility.

Economic systems can be tightly linked to the natural resources of the area. This study demonstrated that public media discussed economics 86% more often than scientists. Economic issues have social importance that span multiple generations and have extended implications on regional scales (Keller, 2009). In the Northern Forest, timber is an economic driver and a significant percentage of workers are employed in an industry related to timber processing. The realization that the three species studied here can devalue timberlands in a short time span has the ability to evoke a similar emotional response as the realization that these species can cause the American landscape to undergo drastic change.

It is evident that ecological concerns relate back to other value categories, but they also extend beyond aesthetics and economics to issues of lifestyle sustainability, biosecurity, ecosystem services, and the general standard of living. Again, conservation of regional ecological stability and viability is dependent upon public interest and political

action from large groups of citizens along a continuum of ecological knowledge bases (Bright, 1998). Ecological concerns are temporally primary with these species specifically. It is interesting, however, that the study showed that public media discussed ecology 86-90% more often than scientific researchers.

The rate of use of connotatively negative language in online news media was between 63% and 87% greater than that in scientific journal articles. Each species has affected the regions that the articles originated from in different ways, to different degrees, and within different time frames, which may explain the disparities. Although each species utilizes one or more native tree species with market values as hosts, they lack many similarities beyond that. They differ in appearance, life history strategies, and eradication methods, but the media portrays them in the same light, with a strong tendency toward the use of specific and repeated words or phrases, such as menace, evil, aggressive, opportunistic, or pest. This can be attributed to many factors, including journalists' stylistic preferences, a fear of the bland or subdued neutral, unintentional author bias, the desire to invoke civic and political action, and differing objectivity standards for natural scientists. Granted, many of these terms are anthropomorphic, so the use of certain syntax may also stem from a journalist's need to make the subject of the article relatable and comprehensible to the reading public.

It is reasonable that the public media will seek more fodder about social themes and play into human value systems more than scientists



because scientists aim to satisfy a set of standards that focus on the gravity of their work rather than the response to their words in the world purview. For all categories, the media was more than 60% more likely to utilize the literary devices in question than scientific journals, and in some categories, the figures neared 90%. In other words, environmental journalists used suggestive language nearly twice as often. This raises questions about the way the everyday American perceives ecological issues developing in their surroundings as an artifact of their information and communication sources.

Through anthropomorphism, journalists force invertebrates or other invasive species into the frame of sentient beings that act intentionally. The use of connotatively negative language (pest, menace, aggressive), has a similar effect. The notion that these species act intentionally is incorrect- they are simply following a life history strategy that took millennia to evolve on another continent. They do not purposefully degrade valuable timberlands or cause ornamental trees to wither and die, so it may be dangerous to assert to the public that this is the case. Yet, it is most likely just as dangerous, if not more dangerous, to allow these species to continue unchecked. Control and restriction of invasive species requires a holistic effort from personnel in many fields; scientists are not equipped to face environmental issues alone. This creates a tension across an array of social boundaries because an agreement must be forged as to how to communicate the needs of society as a whole.

One of the aims of this analysis was to elucidate that the topic of invasive species is socially loaded due to its tight linkages to economics, aesthetics, and ecology, and these categories are apt to social construction, in contrast to objective rationality. Construction by definition stands beyond the realm of objectivity, which amplifies the conflict. The problem we face here is not necessarily one of word choice with the intention of swaying audiences. Journalists may be communicating with the public about scientific and environmental issues in the most effective manner possible, but our cases demonstrate that many questions remain unanswered with respect to the synthesis of scientific research and environmental journalism.

It is difficult to extrapolate this data to a conclusion about the implications of the use of influential language in easily accessible media, and this would be a good avenue for further investigation. It can be posited, however, that the relationship between scientific research and mainstream news sources is one that must be carefully navigated to ensure fair consideration to the readers, the research, and the ecosystem.

A new discourse is required to mitigate the intersections between human value systems and natural processes. Life will continue, unfettered, and will find a way to evolutionarily circumvent anthropogenic roadblocks. A paradigm shift is developing to realign our thinking in regards to an anthropocentric world, and for it to be successful, environmental education paired with citizen advocacy is

necessary. The tension created by divergences in syntax and language choice brings about a new avenue in environmental communication. It may not be possible to rid us of frames or social constructions because these may be inherent in human nature, but cognizance of their existence and implications on human discourse can bolster a deeper understanding of the human relationship to nature.

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